

## THE PRODUCTION AND DISPOSAL OF PIGS BY KUBO PEOPLE OF PAPUA NEW GUINEA

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In 1986-87, a small community of Kubo people, of the interior lowlands of Papua New Guinea, kept from 0.27 to 0.54 domestic pigs per person. The animals were fathered by wild boars and born to both wild and domestic sows. Male pigs were castrated. For about 18 months each pig was in the care of a particular woman; thereafter, it was released to forage in the backswamps but was regularly monitored by its carer and, like village-based pigs, provided with much fodder, particularly the pith from sago palms. An exceptionally close bond was established between each domestic pig and its carer. Men contributed little to the management of domestic pigs, and carers participated actively when pork from pigs that had been in their charge was distributed. Domestic pigs were not important as a protein source. Their significance was primarily social. On several counts, patterns of production and disposal of pigs by Kubo did not conform to expectations based in earlier comparative and theoretical analyses of New Guinean procedures. Kubo patterns are located within a comparative frame that concerns ratios of pigs to people, work entailed in maintaining pigs, nutritional matters and gender roles. □ *Socio-ecology: animal husbandry, domestic pigs, nutrition, protein, gender roles, Kubo, Western Province, Papua New Guinea.*

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Domestic pigs are important to most New Guineans. They are often focal in the social exchanges that connect different groups of people and, through the time and labour entailed in management, significant in the ecological exchanges that connect people with environment (e.g. Morren, 1977; Rubel & Rosman, 1978). These linked dimensions of the role of pigs were made clear in Rappaport's (1968) classic study among Tsembaga Maring. Indeed, in recent literature that addresses questions of social and agricultural evolution within New Guinea, the place of pigs is central (e.g. Feil, 1987; Kelly, 1988; Bayliss-Smith & Golson, 1992).

Despite the importance of pigs to both New Guineans and anthropological theorists there are few studies that include substantive detail of the husbandry practices of specific groups of people (cf. Boyd, 1984). Notable exceptions are Rappaport (1968), Hide (1981), Boyd (1984, 1985) and Kelly (1988) but these do not capture the full diversity of New Guinean pig-keeping practices (cf. Baldwin, 1990; Yen, 1991). Without an appreciation of that diversity the value of comparative analysis and evolutionary speculation will remain limited (Hide, 1981: 563).

This paper describes the production and disposal of pigs by a small group of people living in the interior lowlands of the Western Province of Papua New Guinea. These people are hunter-

horticulturalists who, on the basis of extrapolating from earlier theoretical literature (e.g. Morren, 1977; Watson, 1977; Modjeska, 1982; Feil, 1987; Kelly 1988; Baldwin, 1990) might have been expected to keep few pigs or none at all, rear only wild-born piglets, raise them on forage rather than fodder, devote very little time or effort to their maintenance and use them to meet nutritional rather than social needs. Kubo people did not conform to these expectations.

### KUBO PEOPLE

About 450 speakers of the Kubo language live north and northwest of the Government station at Nomad, Western Province, immediately south of the Muller and Blucher Ranges (Fig. 1; Dwyer, Minnegal & Woodyard, 1993). Between August 1986 and November 1987, with Monica Minnegal, I lived with 25 people at the village of Gwaimasi (5°54'S, 142°6'E; 80m ASL) on the west bank of the Strickland River. Our research embraced all aspects of the socio-ecology of the people and earlier reports provide details of environment, subsistence, social life and the historical context within which we worked (e.g. Dwyer & Minnegal, 1991a,b, 1992a). Details of the composition of the village population are available in Dwyer & Minnegal (1993). Here, I summarize

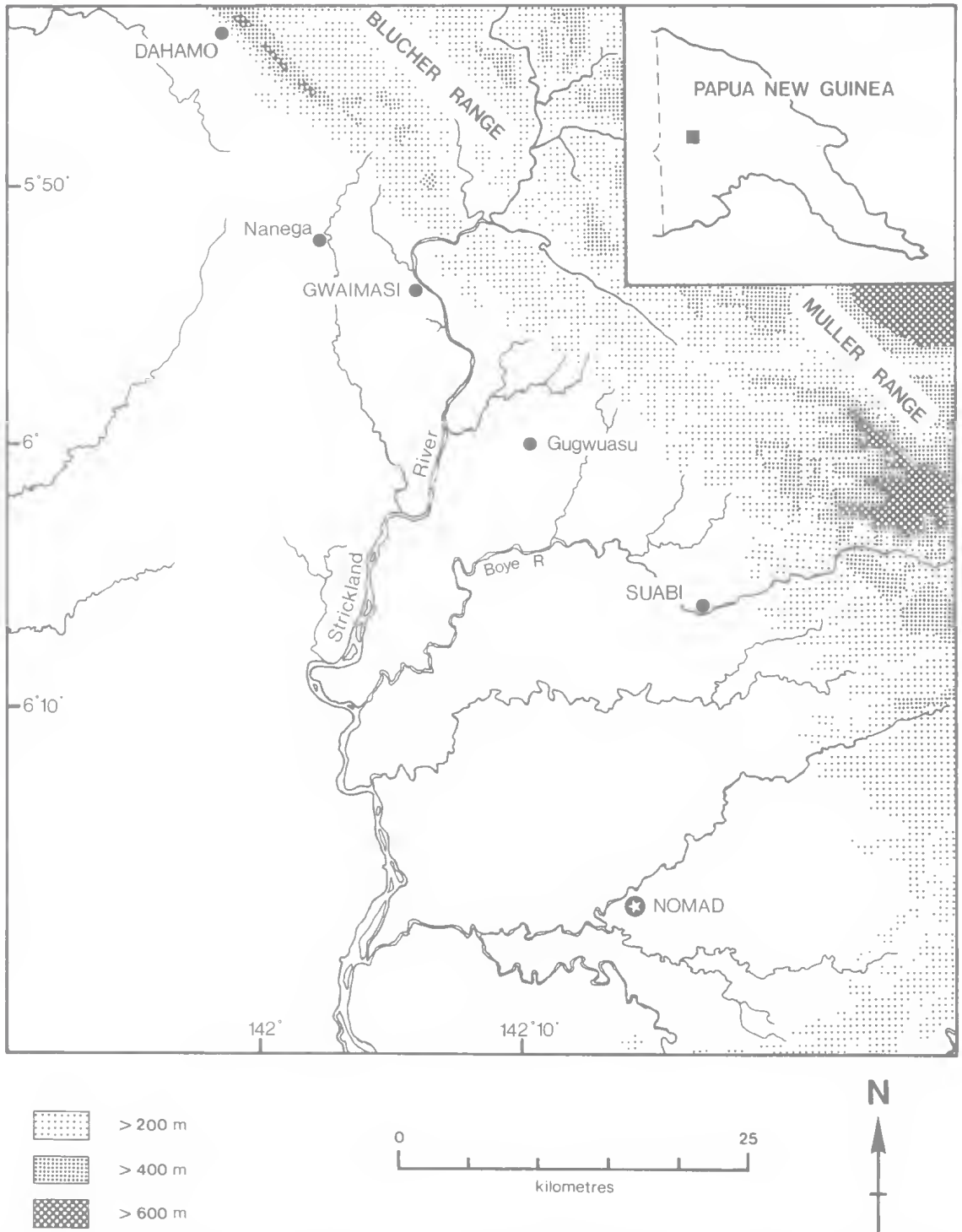


FIG. 1. Location of Gwaimasi and neighbouring communities. The large symbol shows the Government station at Nomad. Small symbols show villages mentioned in the text; names of Gwaimasi and neighbouring mission stations are capitalized.

information that is relevant to reporting matters about domestic pigs.

Gwaimasi village was centrally located within 50km<sup>2</sup> of foothill rainforest and swamp forest that was drained by numerous streams and the Strickland River itself. Within this area the residents of Gwaimasi produced their food. Rainfall was approximately 6m per year with recorded monthly falls never less than 300mm. The people grew bananas at small unfenced gardens made on levee banks of the river and larger streams, and extracted sago flour from both planted and wild *Metroxylon* palms that were abundant in the backswamps. These carbohydrate foods were of approximately equal importance though at different times one or the other was dominant.

Most protein was derived from animals. Wild pigs and catfish contributed most protein, in terms of weight, but many other vertebrates and invertebrates were included in the diet. Forest products, other than animals, were used as food (e.g. fern fronds, fungi, wild yams and the fruit, nuts and leaves of certain trees) and to fulfil many material needs (e.g. clothing, building and the manufacture of hunting equipment and canoes). Despite the apparent commitment, encouraged by Government and Mission contact, to establish and live in villages Kubo people remained very mobile both within and between local subsistence zones. At Gwaimasi, family groups spent long periods living at forest and garden houses away from the village and often, at these times, had little or no access to garden produce. Since about 1960 there appears to have been increased emphasis upon gardening and less emphasis upon sago extraction to satisfy calorific needs (Dwyer & Minnegal, 1992a).

Dogs and pigs were kept as domestic animals by Kubo. There were nearly as many dogs as there were people and the animals were essential to the successful pursuit-hunting of wild pigs. Domestic pigs, the subject of this paper, were less numerous. My concern here is with what Hide (1981: 406-407) called the 'ecological population': the domestic pigs cared for by a localized group of people within the area that the people themselves routinely traversed. This population need not be identical with the 'sociological population' which comprises the domestic pigs owned by a localized group of people irrespective of where those pigs are located. In New Guinea this distinction is necessary because agistment of pigs is common.

I classed domestic pigs as either 'tended' or 'free foraging'. Pigs in the former category were under almost daily supervision and spent nearly

every night at or near the houses where their carers slept. Pigs in the latter category had been released to forage alone in the backswamps. At different times during its life a pig might qualify as 'tended' or as 'free foraging'. Sometimes a 'tended' pig failed to return to the village for several successive nights. Analyses presented here do not reclassify these cases as 'free foraging'; categorization as 'tended' or 'free foraging' takes the *intention* of the pig's carer to be primary. A recalcitrant 'tended' pig simply increased the work load of its carer who now had to search for it. 'Primary carers' are defined as women who had primary responsibility for particular pigs, wherever those pigs were located, and 'secondary carers' as people who were in charge of pigs for which they did not have primary responsibility. People were classed as carers of 'tended' pigs only if they had been responsible for those pigs through the day and following night. Brief periods of assistance provided during the day are not included in the analyses though they were common. Public perceptions were such that there was no ambiguity concerning the identity of primary carers of 'free foraging' pigs. My classifications of domestic pigs as 'tended' or 'free foraging' and of carers as 'primary' or 'secondary' conform closely with Kubo perceptions.

Most of the data reported below were obtained by monitoring the activities and locations of people and pigs, by direct observation of circumstances of disposal and by asking questions. Estimates of pig weight should be regarded as rough approximations. I did not have direct access to domestic pigs for measurement; the people, but not the pigs, would have tolerated this intrusion. However, where possible, wild pigs were weighed after they were killed and, before weighing, I could usually judge the weight to within 10 percent. Sixteen wild pigs with a weight range from 1.5 to 74.5kg yielded the following relationship between weight ( $W$  = intact weight in kilograms) and mandible length ( $M$  = length of horizontal ramus of mandible in millimetres):  $\log W = 2.91 \log M - 5.07$ . In a few cases this formula was used to estimate the weight of domestic pigs; values obtained in this way are underestimates because domestic pigs were usually fatter than their wild counterparts. Edible weights were estimated as 0.65, 0.70 and 0.75 of intact weight for, respectively, pigs heavier than 10kg, between 5 and 10kg, and less than 5kg.

### THE PIG POPULATION

Between September 1986 and November 1987 from seven to 13 domestic pigs were managed by residents of Gwaimasi (0.27 to 0.54 pigs/resident; Fig. 2). These values include piglets only from the date they were removed from sows and taken into the care of women. Piglets that were either eaten ( $n = 13$ ) or exported beyond the Gwaimasi area ( $n = 1$ ) on the day they were taken from a domestic sow were not counted as members of the population.

In September 1986 there were five sows and four large males; four of these animals had been born to domestic sows, the status of the others is not known. Three of the males were confirmed as castrates and the fourth was probably a castrate. One of the sows and two of the males were alive in November 1987. All recruitment during the period of study was as small piglets: five born to local domestic sows, three born to wild sows and one as an import from a neighbouring community. Males and females were included among the recruits but details are incomplete. Losses from the population were four natural deaths at estimated weights of 1.0, 1.5, 4.0 and 12.5kg and seven pigs (15-80kg) killed by people; only the latter were eaten.

Peak biomass of the pig population was in December with about 20kg live weight per resident (Fig. 2). Removals for consumption in January and March halved this value and the combination of additions, estimated growth and losses through the next 7.5 months resulted in only a minor increase in per-person biomass.

### MANAGEMENT OF PIGS

At Gwaimasi, all pigs, from the time they were taken from sows, were in the care of women. The 'caring' role was unevenly distributed among available women and was strongly connected with their current reproductive status (Table 1). Caring for pigs was incompatible with caring for a nursing infant. Thus, Wafu and Gogoi did not have 'tended' pigs, Mabei's 'tended' pig was killed six months before she gave birth and the 'tended' pigs of Kose and Bowa were cared for by other women from shortly before Kose and Bowa gave birth, to several weeks after their

infants died. The perceived danger to small infants arose from the possibility that pigs might consume body wastes and proximity between pigs and babies was avoided both at the village and in the forest. (Kubo people believed that an infant's health was placed at risk if its body wastes were eaten by pigs.) Carers assumed the primary responsibility for this, though, in the forest, mothers disposed of their infants' wastes and, at the village, one couple enclosed the area beneath their house so pigs could not reach wastes that might fall through the slat floor. In fact, pigs were not allowed to wander at will within the village area<sup>1</sup>.

The married but childless woman Sisigia participated actively as a carer but it was the widow Gogo who contributed most (i.e. 41% and 64% of days associated with the care of 'tended' and 'free foraging' pigs respectively). As a widow who was probably postmenopausal Gogo's lack of direct association with nursing infants was more certain than that of any other woman. One teen-aged girl ceased caring for a young pig at the time of her departure from the village to marry and another, who came in marriage, did not assume the role during the following 10 months. The caring role may have been constrained during early marriage.

The foregoing depicts differential patterns of responsibility but does not reveal the varied nature or extent of those responsibilities. I turn to these matters here, summarizing developmental events in the life of domestic pigs and the work associated with their care.

Domestic sows were impregnated by boars that lived in the backswamps. Of six successful matings, three occurred after our arrival; two of these latter were to a 'free foraging' sow and the last was to a 'tended' sow. The last case shows that insemination by wild boars did not require that sows were managed as 'free foraging' animals (cf. Kelly, 1988: 155).

When births were expected, carers or their agents monitored the sow regularly or, if it was a 'tended' pig, released it into the backswamps or remained with it away from the village. Neither pigs nor women gave birth at the village. Most piglets were captured and either killed or retained when they were from two to four weeks old. In one case a piglet was allowed intermittent access to its mother for a month after capture and, in

<sup>1</sup>Monica Minnegal and I visited Gwaimasi for six weeks in October and November 1991. During the first four weeks there were no children under three years and two large 'tended' pigs often wandered free near the edge of the village clearing. A child was born on November 12, 1991 and, from that time, the pigs were always tethered when mother and child were present.

another, a piglet was left with its 'free foraging' mother for six or seven weeks before it was killed and eaten. Management procedures of these kinds could inhibit return to oestrus by sows and, hence, allow some control over the timing of pregnancies (cf. Hughes & Varley, 1980: 149-151).

Capture of piglets born to domestic sows entailed an overnight stay away from the village by four to six people (female and male) together with some dogs. The presence of dogs resulted in the immediate death of some piglets and injury to others. One badly injured piglet failed to eat sat-

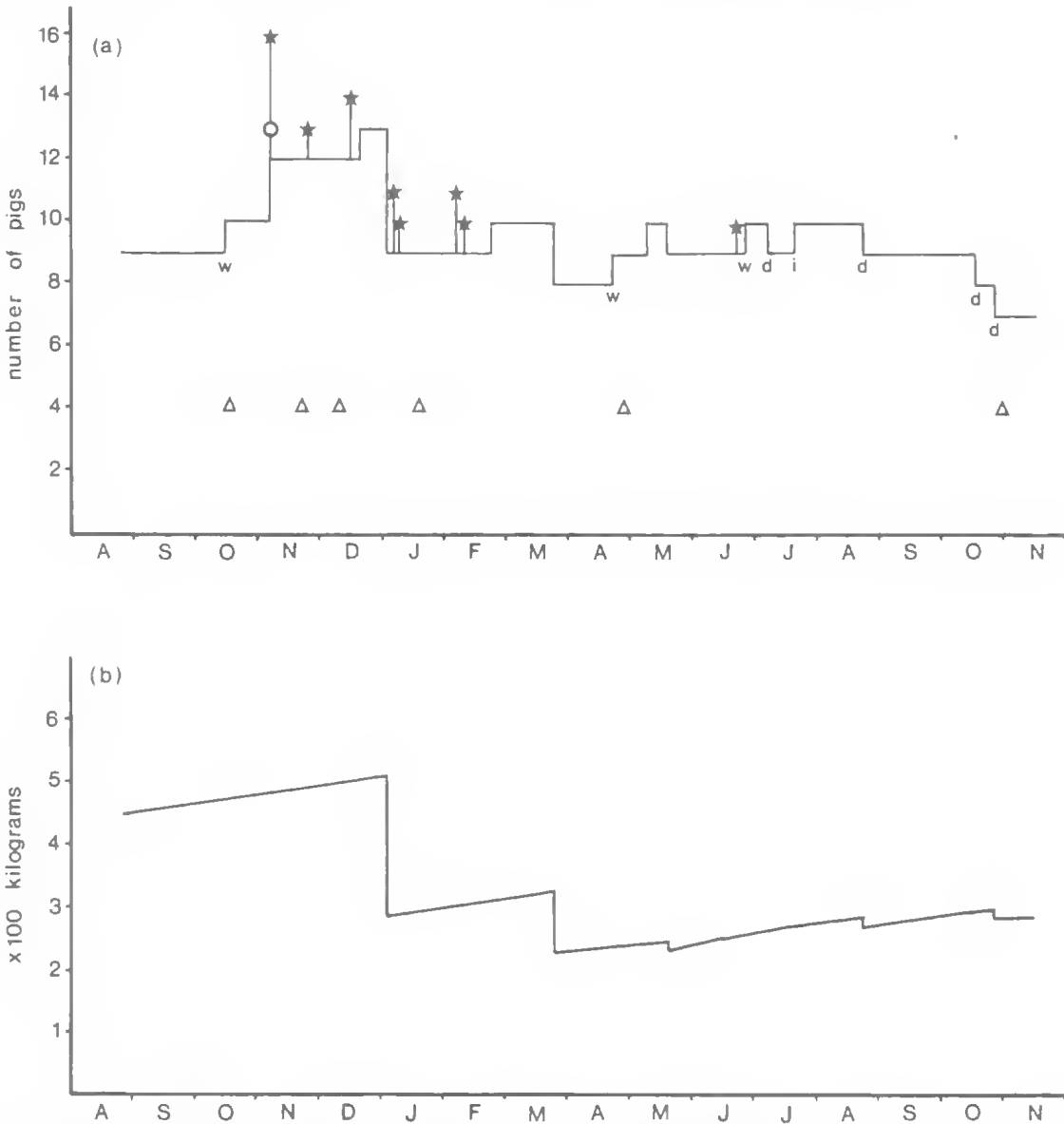


FIG. 2. (a) The size and (b) approximate biomass of the population of domestic pigs; August 1986 to November 1987. In section (a) vertical lines terminating with a star indicate piglets that were captured from domestic sows and killed and eaten on the same day; the open circle indicates one piglet that was exported on the day of capture. 'w' denotes recruitment of piglets born to wild sows, 'i' denotes an imported piglet, 'd' denotes natural deaths and open triangles record the approximate dates on which domestic sows farrowed. Capitalized letters on the horizontal axes code consecutive months.

TABLE 1. The cumulative numbers of days spent caring for pigs by female residents of Gwaimasi: August 25, 1986 to November 15, 1987<sup>1</sup>.

Female <sup>2</sup>	Age <sup>3</sup>	Tended pigs					Free foragers
		1 <sup>o</sup> carer		2 <sup>o</sup> carer		total	
		village	forest	village	forest		
Gogo	45	650	327	31.5	6	1014.5	1005
Kose	40	177	84	2	—	263	26
Sisigia	30	330	141	12.5	—	483.5	—
Mabei	25	86	17	6	1	110	441
Gogoi	22	16	—	12	—	28	90
Wafu	20	—	—	10.5	13	23.5	—
Bowa	20	239	156	60.5	15	470.5	—
Yasobidua	15	—	—	—	2	2	—
Mugwa	14	68	31	4	—	103	—
Total		1566	756	141 <sup>4</sup>	37	2500	1562

1. Values are partitioned according to the status of pigs as 'tended' or 'free foraging', as village-based or forest-based in the case of 'tended' animals, and as associated with a primary or secondary carer. All effort associated with pigs classed as 'free foraging' is attributed to primary carers though this does not accurately represent the facts (see text for further details). Half values appear in the table because two women sometimes shared the role of secondary carer. Details are not known for 173 carer-days.

2. Kose gave birth on June 10, 1987 and the child died on July 11, 1987; Mabei gave birth on July 1, 1987 and was lactating thereafter; Gogoi was lactating throughout; Wafu gave birth on January 9, 1987 and was lactating thereafter; and Bowa gave birth on July 9, 1987 and the child died the same day. Yasobidua became a resident of Gwaimasi on January 30, 1987 and Mugwa's residency ceased on the same day. The following values record the numbers of 'tended' and 'free foraging' pigs attributed to each primary carer followed by the maximum number of pigs in care at any one time: Gogo 6,3,6; Kose 2,0,2; Sisigia 2,0,2; Mabei 1,1,2; Gogoi 0,1,1; Bowa 2,0,2; Mugwa 1,0,1. When Mugwa departed from Gwaimasi her pig was transferred to Gogo's care.

3. Ages, in years, are estimates only.

4. The caring role was attributed to a visiting woman on one day and to the husband of a primary carer on another.

isfactorily and grew exceptionally slowly during 6.5 months after capture.

For more than a year after capture, pigs were closely associated with carers. For a week or two they were carried, often but not always in string bags, and petted and kissed by their primary carer and other females. From the outset they were trained to accept a lead attached to one front leg and, within a few weeks, would be led to and from the village and allowed to run free when in the forest. But intermittent carrying often continued for three months or more, by which age young pigs had been personally named and were sometimes tethered alone or near another pig in the forest. At about four and a half months their ears and tail were cut and males were castrated, and not until about five months did they spend a day foraging in the forest near the village untethered and unaccompanied by their carer. As long as they remained 'tended' pigs they were usually taken from the village on a lead though, when older than one year, they might often return untethered in the evening.

The precise timing of the events described varied between both piglets and carers. Piglets that grew slowly were treated as though they had aged slowly and some carers were more inclined than others to reduce effort by hastening the independence of pigs. Piglets usually slept in the house of their carer for the first three or four months after capture and were then tethered at night under the house. But, in one case, this bond was not broken until nine months and then only after the carer's husband became seriously ill. Women who prolonged a close attachment to pigs were also more inclined to punish misbehaviour by shouting and smacking; children were never punished in these ways unless, as infants, they defaecated in public.

The bond between pigs and their carers was strong and the effort entailed was considerable. The strength of the bond is evidenced by the minor involvement of secondary carers (Table 1) and by the facts that secondary carers were more likely than primary carers to be resident at the village (79% vs 66%;  $P < 0.01$ ) and less likely than

primary carers to take the pig to the forest to forage (56% of 68 vs 91% of 597 recorded days;  $P < 0.001$ ). When pigs that usually free foraged were located at the village secondary caring was rare (one in 52 observed days) and even the primary carer was unlikely to take the pig into the forest (two of 51 days). Other people's large pigs were difficult to manage; only after about a week of close attention from a secondary carer did even a moderately large pig become manageable.

At the village, carers were responsible for keeping pigs away from the central village area and from small household gardens, for tethering the animals at night and for matters of hygiene (e.g. cleaning sleeping quarters and removing faeces that were dropped when pigs were taken through the village to the forest). Ropes, made from the bark of trees, were made for tethering and as leads and the animals were often groomed by their carer. The pigs also had to be fed. Fodder was usually provided both in the morning and the evening. In addition, pigs were often taken to the forest where they might be tethered, accompany the carer at her pace (on or off a lead) to a place where she intended working or released to forage alone. Pigs were also 'herded', meaning that a carer accompanied by a pig or pigs, travelling at their pace, either took more time than needed to reach a place (e.g. a garden) where she intended working or spent many hours in the forest for the sole purpose of allowing the pigs to forage.

The relative importance of these different management strategies cannot be quantified here beyond noting that pigs were taken to the forest on a minimum of 87% of the days when they, and their carers, were based at the village ( $n = 665$ ). Pig management was often embedded in other activities undertaken by carers and different carers favoured different strategies. Two women who often worked at gardens near the village favoured forest tethering; four others who worked at more distant gardens favoured other strategies. Their preferences were probably influenced by the risk that untethered pigs might return to the village and raid household gardens.

Bananas and the pith (*woko*) from sago palms were the staple fodder provided to 'tended' pigs. (Very occasionally both 'tended' and 'free foraging' pigs were fed fish. Sario-Hewa and Gadio Enga also sometimes fed small animals to their pigs; Townsend, 1969: 50; Domstreich, 1973: 245) Women who were based at the village nearly always took their pig(s) to places where they processed sago palms; the pigs fed at the accumulating heaps of waste pith. Chunks of *woko* from

these palms were carried to the village and fed to pigs at night; portions were sometimes given to women who had not worked but who had pigs. Other palms were felled as fodder for pigs and large quantities of *woko* were buried in muddy stream beds for retrieval as needed. Again, palms at which flour extraction was completed were visited by women who 'herded' pigs. During 14 months, at least five palms were felled to provide fodder for village-based pigs that, additionally, had access to waste and unused pith from 17 palms processed on behalf of people. Only once did I see sago flour fed to a pig. In this case a woman chewed sugar cane, spat the sweet extract into crumbled flour, and hand fed the mixture to a small, sickly piglet.

When bananas were abundant they were often fed to pigs. They were cooked green, usually by boiling, peeled and sometimes mashed before delivery on a platter to the pig. Between August and November 1986 banana production was low and few were fed to pigs. Thereafter, they were used often as fodder. A tentative estimate is that at least 200 bunches of bananas were fed to pigs from September 1986 to October 1987; this represents six percent of total banana production at Gwaimasi and nearly 500g edible weight of bananas per pig for each day it was village-based (Dwyer & Minnegal, 1993). I did not see ripe bananas fed to pigs, which contrasts with Beek's (1987: 19) observation that Bedamuni, who live to the southeast of Kubo, regarded ripe bananas as fit for pigs (and anthropologists!) but not for people.

The management of 'tended' pigs was less constrained when carers lived at forest houses away from the village. Pigs could forage freely in the forest though they were encouraged to return to the house each evening and were probably usually provided with some fodder. Bananas were seldom available as food - gardens made at a distance from the village had not yielded by the time we departed - but waste and untreated pith from sago palms were available more often than at the village. The pith from 18 palms processed to provide flour was available to 'tended' pigs when they resided with their carers away from the village; i.e. 44 vs 77.5 pig-days per palm when pigs resided at the village. It is likely that additional palms were felled to fodder these pigs.

The management of 'free foraging' pigs was largely invisible to me. Contact was maintained through visits by the primary carer or by a secondary carer who monitored the whereabouts of the pig and reported pending or recent births. Be-

tween December 1986 and November 1987 Gogo visited and remained in the area where two 'free foraging' pigs were under her care on 11 trips totalling 82 days. Similarly, from November 1986 to November 1987, Mabei visited and remained in the area where one pig lived on nine trips (26 days) and Sisigia, who often monitored this pig, visited the area on another 14 trips (39 days). These values exclude day trips to the areas. Activities other than those concerned with pigs were often undertaken during these trips though, in fact, Mabei's 'free foraging' pig was focal to eight of her nine visits.

At least five sago palms were felled as fodder for 'free foraging' pigs and the animals had access to left-overs from at least 15 sago processing ventures (approximately 79 pig-days per palm). Four of the palms were felled during a five month period on behalf of one sow (47 pig-days per palm) and it is probable that the number of palms felled for 'free foraging' pigs greatly exceeded five. At Gwaimasi the pigs classed as 'free foraging' may have been effectively foddered for much of the time though, because the fodder was sago pith, the effort entailed was not great.

By New Guinean standards Gwaimasi pigs were relatively well fed. Estimates suggest that weights in excess of 27.5kg were reached by 60 weeks; at the same age the mean weight of highland pigs from Sinasina, Simbu Province, was 21.6kg (Hide, 1981: 474). Hide remarked that Sinasina pigs grew slowly. All 'free foraging' pigs in the Gwaimasi area exceeded 40kg and two females were 42.5kg and 55kg respectively after birth of their first litters. Hide (1981: 475) reported that sows less than 25kg gave birth in the Sinasina area.

Among Kubo, 'tended' pigs were not released as 'free foragers' until they were about 18 months old and it was only near this age that females attained reproductive maturity (cf. Malynicz, 1970; Hide, 1981: 453).

In October-November 1991, 34 people were classed as residents of Gwaimasi (including one birth and one arrival in the period) and 16 pigs were located in the area. One of these pigs was a five year old barrow. The pigs to people ratio of 0.47 is reduced to 0.40 by including eight people, and one pig, who were formally aligned with Gwaimasi but spent most of their time at Dahamo (Fig. 1) where a primary school was located. Seven of the 16 pigs were 'tended' and one was 'free foraging'. The other eight, owned by members of five families, were in the care of a married couple, who had no children and lived at a fenced

tuber garden on the east bank of the Strickland River. In 1986-87 and in 1991 some 'herds' of large pigs, owned by residents of the mission station at Suabi (Fig. 1), were, similarly, in the care of elderly couples without young children, who lived as much as a day's walk from Suabi. 'Swine-herding' of this sort is certainly a recent practice among Kubo. At Gwaimasi, people said they initiated the practice because pigs were spoiling gardens. This assertion sits uncomfortably with an emphasis on growing bananas, which are not attractive to pigs, with the 1986-87 observation that 'free foraging' pigs seldom spoiled gardens and with the lack of concern that wild pigs were a threat to banana gardens. In addition, the people could have fenced gardens or separated 'free foraging' pigs and gardens by the river without the need that some people lived with those pigs. Hyndman (1979: 212) reported that among Wopkaimin 'all pigs (were) kept in residentially separate pig houses ... or in hamlets used solely for pig raising'. As with Kubo in 1991, these animals were in the care of specially appointed community swine-herds (Hyndman, pers. comm.).

## DISPOSAL OF PIGS

From August 25, 1986 to November 15, 1987 449.6kg of domestic pork (edible weight) were available for consumption at Gwaimasi (Table 2). This value includes all the meat from seven pigs in the care of Gwaimasi residents, four pigs in the care of non-Gwaimasi residents and 13 piglets, born to Gwaimasi sows, that were killed on the day they were taken from those sows together with portions of two pigs and one piglet that were carried as gifts to Gwaimasi. Forty-seven percent of this meat was consumed by Gwaimasi residents; an average of 25g per adult-equivalent day of residency (28g with Europeans excluded). The remaining 53% was consumed by visitors to Gwaimasi. The yield of edible meat from wild vertebrates was 255g per adult-equivalent day of residency with 56% derived from wild pigs (Europeans excluded; Dwyer & Minnegal, 1991b). Clearly the total contribution of meat from domestic pigs was minor. Nor was the killing of pigs timed to fill lulls in availability of meat from wild vertebrates; much meat from the latter was available at the time of the feast, on the day before 'nuisance' pigs were killed and on the dates of two curing rituals at which 10kg or more of domestic pork was available (see Table 2).



TABLE 2. Disposal and consumption of domestic pigs at Gwaimasi.

Description	Pigs killed (n)	Days pigs killed (n)	Total kg (edible)	Proportion consumed by residents
Payment to spirit medium	1	1	34.13	0.29
Feast	6	1	292.50	0.37
Curing ritual	3	3	36.24	0.61
Management: 'nuisance'	2	1	63.38	0.76
Management: piglets	12	7	17.40	0.86
Received as gifts <sup>2</sup>	3	3	5.95	1.00
Totals	27	14	449.60	0.47

1. Meat was widely and equitably shared by Kubo people. Estimates of the amounts of pork consumed by Gwaimasi residents assume, unless otherwise known (see text), that residents and visitors received shares in proportion to their numbers.
2. Portions of pigs sent as gifts to Gwaimasi; the combined weight of these portions is taken as the total weight.

Of the total edible weight of pork available at Gwaimasi 242.5kg were derived from pigs whose carers were Gwaimasi residents; removal of one pig whose male owner's residency ceased 4.5 months before the pig was killed reduces this value to 206.7kg. The estimate of 210.5kg consumed by Gwaimasi residents is a close fit to these values. However, the proportions of pork contributed and consumed by Gwaimasi residents varied according to the reasons for killing pigs. These reasons are discussed below.

Management considerations (i.e. control of herd size and elimination of 'nuisance' pigs) accounted for the disposal of 11 piglets that were only a few weeks old, one large piglet that for two months had been left with its mother and two sows that, after farrowing, often raided small village gardens. These pigs, all from the local population, contributed 30% of the domestic pork consumed by Gwaimasi residents. Eighty-six percent of the edible weight of the 12 piglets and 76% of that of the 'nuisance' pigs was eaten by residents of Gwaimasi; the latter were killed when the owner of one was visiting and he, with four companions, received a disproportionately large share of the meat.

One small piglet (1.5kg) and two pigs (17 and 40kg) were killed in connection with three curing rituals. The piglet was sacrificed over the heads

of two brothers whose lives were endangered by possible contact with spirits; it was cooked and taken from Gwaimasi for consumption by a visiting male who had danced on behalf of the brothers. At both the other curing ceremonies one hind leg, together with portions of liver and entrails, were needed for ritual purposes (Dwyer & Minnegal, 1988). These portions were subsequently disposed of within the resting place of the spirits of the dead (*toi sa*, forbidden place) through a combination of consumption by bachelor males, burning and throwing to crocodile spirits. Residents contributed 38% of the edible weight of these three pigs and consumed 61%; thus, as hosts to curing ceremonies held on behalf of non-residents, they received more pork than they gave.

On the night before one of the curing ceremonies a visiting spirit medium diagnosed the causes of illness of two people; he received a 52.5kg pig in payment. The animal originated from outside Gwaimasi, was killed and cooked at Gwaimasi and portions amounting to about 10kg edible were given to residents by the spirit medium after he and his son had butchered the cooked meat.

Two medium-sized and four large pigs were killed at a feast on January 3, 1987. These six pigs represented 65% of the total edible weight of domestic pork available at Gwaimasi, and provided 52% of the edible pork consumed by Gwaimasi residents. Residents gave more than they received, contributing 51% and consuming 37% of the edible weight available. The feast was planned several months ahead and preparations were underway in late November 1986. Some people referred to the forthcoming event as *kasimes* ('Christmas', but without recognition of the etymology of that word). Visitors from Gugwasu to the southeast arrived over several days prior to the feast and participated in arrangements. Most residents from Nanega to the west, together with some of their relatives from further afield, made a formal arrival on the evening before the feast. These people had taken several days to slowly lead (and drag!) two large pigs (100 and 120kg) that were to be killed and eaten. This embarrassed the host community which had readied two 'frec foraging' pigs, each at 80kg, to feed guests. Two 35kg 'tended' pigs were selected as additions to the intended contribution.

Many of the people who resided at Gwaimasi, Gugwasu and Nanega in 1986-87 had lived together at a different locality in late 1984. This community had split with the primary division being between what became Nanega and Gwaimasi. Nanega was established as a viable commu-

nity and village before Gwaimasi. The feast of January 3, 1987 is interpreted as an assertion by Gwaimasi residents that they now qualified as an ecologically viable and socially self-sufficient community (Dwyer & Minnegal, 1992a). Further, the feast served to reduce lingering tensions that had underlain earlier fission while, at the same time, revealing elements of intercommunity competition. This last was demonstrated as well when, on the night before the feast, two men who were perceived within their respective communities as Government-appointed 'go-betweens' (*komit*) exchanged gifts. The Gwaimasi man, who was acknowledged as 'the owner of the party', gave one tin of mackerel and a kilogram of rice and 'lost face' when, in return, he received twice the quantity of both food-stuffs.

Small quantities of domestic pork arrived at Gwaimasi as gifts from particular individuals; once, from a married man (or from his wife who had cared for the pig) to an unmarried female in acknowledgement of current restrictions on the consumption of terrestrial game and, again, as part of the distribution of a death-compensation payment to a female relative of the deceased person. Details of the third case are not known. In total these gifts comprised less than three percent of the domestic pork consumed at Gwaimasi.

With the exception of some transfers of small piglets all domestic pig transactions among Kubo were as pork and not as live animals. The primary contexts in which these transactions were made concerned statements of intracommunity solidarity, re-establishment of intercommunity relations, the needs of curing, death-compensation and, very importantly, though not witnessed by me, initiation (cf. Shaw, 1990, on neighbouring Samo). In addition, meat was eaten at feasts held to celebrate the completion of new longhouses and often this was pork. Presumably there were also a variety of situations, beyond the few seen, when small quantities of domestic pork were given by one individual to another.

#### WOMEN, MEN AND PIGS

Among Kubo the role of males in the day to day management of pigs was minor. Certainly, the perceptions of males were that pigs were the responsibility of women and, at the same time, the needs of pigs should not take precedence over the needs of men. It was women who should ensure that pigs did not raid gardens. On one occasion, when a woman cooked food for her pig before doing so for men who had felled trees at her new

garden, a man complained that the work had made him hungry, the woman's priorities were wrong and, after all, the pig had not cut trees!

With women and dogs, men and youths participated in the capture of piglets from sows. At the village, men built secure fences around small yam plots to protect these from pigs (Dwyer & Minnegal, 1990) and it was usually men who felled sago palms used to fodder pigs. Ear clipping and castration were performed by men and they might assist when 'free foraging' pigs, which had come to the village, were returned to the backswamps. Although this last task was not frequent ( $n = 9$  at Gwaimasi) it was arduous because these pigs were not at ease on a lead. The male kin of a carer also contributed by monitoring the whereabouts of 'free foraging' pigs, helping build sleeping platforms at forest houses and, of course, through gardening work that produced food that was fed to pigs.

It was not often, however, that males handled pigs or directly fed them. Only on one day was the role of 'carer' assigned to a male (Table 1) and only once was a man seen to collect stored sago pith to feed a pig. More often a carer's spouse might assist by taking a village-based pig to a nearby tether site and, for several months, a pig of more than 15kg was usually lifted by a man into and out of the house where it was allowed to sleep. Underlying this lack of direct engagement of males with domestic pigs was the relative exclusiveness of the bond between a carer and her pig(s); other people's pigs were difficult for anyone else to handle and at times were dangerous to approach. When a pig charged everyone ran! The most common exception to these observations was evidenced by males, especially youths, who sometimes treated small piglets as women and girls did by petting and cuddling them or, less often, taking them from the arms of a female and running off as though to steal. Youths occasionally carried a piglet in a string bag, either through the village or at departure with the piglet's carer and, once, for about 10 minutes, a 15 year-old youth walked a piglet on its lead around the village domain. His behaviour was that of public display; the transvestism was striking and was reinforced later in the day by an extended period of cross-dressing.

Details of the ownership of pigs are incomplete. Pigs were individually owned by both males and females with early teenagers eligible to be owners. Ownership and caretakership could be coincident and, usually, ownership rights went to the person who captured a piglet from a sow, wild or

domestic. One effect of this latter pattern was to disperse ownership and inhibit opportunities whereby particular owners might increase their holdings. Though, of course, both carers and owners of sows could exert some control over ownership patterns by choosing the participants in piglet capturing ventures. Pigs in the care of a woman were, if not her own, more likely to be - but were not exclusively - those of close kin. The widow Gogo cared for pigs that belonged to a clan brother, an orphaned youth with affinal links and an unrelated male. The eventual fate of some pigs in exchange was decided from the time they were piglets and, thus, long-term commitment to the caring role was itself a component of the perceived value of that exchange (Dwyer & Minnegal, 1992b).

The direct role of Kubo carers was considerable when domestic pigs were killed, butchered and distributed. For several weeks before 'free foraging' pigs were killed they were attended more closely than usual by their carer and, eventually, were brought to the village to be closely watched and regularly fed. At initiation ceremonies the need for attention was reduced by caging the pigs

(cf. Shaw, 1990, on Samo). It was a woman, usually the carer, who, at the time of killing, tethered the pig to a stake, calmed it and stood within a metre or two as a man shot it using bow and arrow.

After pigs had been killed, carers moved away as men dragged the carcass to a rack where it would be butchered. Carers were sad but did not grieve openly, though once the widow Gogo sought relief by taking a year-old child from its mother and carrying the infant for 15 minutes or so. (Public grief by females was more evident when a family dog died.) But carers reappeared when men commenced butchery, standing near and sometimes sitting on the rack. They were likely to be the only women in attendance and, in the later phases of butchery when portions were selected for distribution before cooking, often gave forceful instructions to the men (Fig. 3). Carers contributed to the actual distribution of these portions and were sometimes the sole distributors; they also apportioned and distributed entrails, which women had washed, to other women. At this late phase of the pre-cooking butchery and distribution, when most males had



FIG. 3. The woman Kose gives instructions as a pig she cared for is butchered and readied for distribution. A second woman at the butchering rack was a visitor to Gwaimasi who had been primary carer to another pig that was killed on the same occasion.

dispersed, carers might move freely about the rack as they completed a variety of tasks. Women did not contribute to laying the primary oven though some might cook ribs on an open fire for general distribution before that oven was opened. Carers reappeared and observed carefully as men took cooked pork from the oven and they sometimes participated by instruction and action in the apportionment and distribution of this meat after males had carved it.

The participation and rights of carers in the apportioning and actual distribution of pork from domestic pigs were considerable. The almost exclusive bond that existed between carer and pig presumably underlay this. Certainly, the carer was needed at the moment of killing - few other people could have tethered or calmed the pig. However, the extent of female participation varied. It was probably greatest when ownership coincided with caring. It was relatively subdued at more formal events that were attended by many guests or when they, as carers, had come as visitors with their pigs. Again, when two pigs were killed in connection with a curing ceremony that was under the close supervision of a visiting spirit medium, it was he who controlled both carving and distribution after the pork was cooked; there was no contribution from women.

## DISCUSSION

This report of Kubo pig husbandry practices is based on detailed observations of a small number of pigs kept by a small number of people. These observations are sufficient, however, to show that Kubo practices were distinctive. They did not fit expectations derived from general and theoretical statements concerning the variety of strategies from New Guinea. In this sense the Kubo case enlarges understanding of the diversity of connections between people and pigs. The primary aim of the following discussion is to locate the Kubo system of pig production and disposal within a comparative frame; to highlight similarities with, and differences from, other New Guinean systems. After brief comparative comment on ratios of pigs to people I discuss (a) the work entailed in maintaining pigs, (b) the importance of domestic pigs to nutrition and (c) connections between pigs and gender roles.

### PIG POPULATIONS

Ratios of domestic pigs to people vary widely throughout mainland New Guinea (e.g. Feil, 1987: 45; Kelly, 1988: 150). In broad outline

these ratios are relatively high (0.60-2.0 or higher) among societies of the Central Highlands and some fringe highland groups that are either structurally and ecologically similar to, or interact often with, the former; low (0.10-0.30) among middle and low altitude societies of the rainforested interior that have little or no contact with the Highlands; and variable (0-1.0) among coastal and near coastal societies.

Geographically, ecologically and socio-culturally Kubo may be best aligned with low and mid-altitude societies such as Bedamuni, Baktaman, Wopkaimin, Miyanmin, Hewa, Sambra and Umeda where ratios of pigs to people are less than 0.30 (Gell, 1975; Hyndman, 1979; Herdt, 1981; Beek, 1987; Kelly, 1988: 150). Indeed, their territory is contiguous with that of Bedamuni to the southeast and within 60km of Baktaman to the northwest. Data from 1986-87 and 1991 reveal that Kubo kept more domestic pigs per person than did any of the other societies within this cluster. The recorded ratios of 0.27-0.54 are intermediate between those of broadly similar societies and those of Highland societies. Relative to these societies, however, Kubo are by no means intermediate according to other criteria (e.g. human population density, agricultural intensification, importance of sweet potato, existence of ceremonial cycles in which pork or live pigs are exchanged, or gender relations) that have been sometimes connected with the relative abundance of domestic pigs.

The comparative data from 1986-87 and 1991 suggest that the size of the Gwaimasi pig population in the earlier period was neither an artefact of circumstances prevailing at that time nor solely attributable to the extraordinary performance of one carer. In 1991 it was Sisigia, with her spouse, who acted as swine-herds and who had, in effect, assumed the earlier role of the widow Gogo (cf. Table 1). Gogo, in 1991, acted as primary carer to only one 'free foraging' pig. Again, in 1986-87, there was no evidence that Kubo people had increased the size of pig herds through recent decades in response to diffuse impacts of modernization. This contrasts with Kuchikura's (1990) report that Faiwol speakers, at 1000m altitude in the Upper Murray Valley, have, through the past decade, increased reliance upon sweet potato and simultaneously increased the size of pig populations.

### PIG MANAGEMENT

Throughout the Central Highlands and in some fringe areas the absolute densities of people and

domestic pigs are relatively high. Maintenance of pigs in these areas is reliant upon provisioning the animals with food, particularly sweet potatoes, that has been grown for this specific purpose. Kelly (1988) described these systems of pig production as 'fodder-based'; they are labour intensive systems that may vary according to the relative importance of fodder and forage (cf. A.J. Strathern, 1988: 198).

Fodder-based systems of pig production permit relatively high ratios of pigs to people. But in some areas of New Guinea similarly high ratios may be achieved in a different way. Among Etoro, of the highland fringe, and Elema, of the coastal lowlands, human population densities are comparatively low but the ratios of pigs to people are like those seen in the Highlands (Kelly, 1988). The lack of significant human impact on forest habitats provides opportunities to forage domestic pigs on 'wild' foods. In these societies, therefore, after an initial period in which young pigs receive close attention and much fodder from carers they are released to forage alone. Pigs that are managed in this way become bonded to their carers and, particularly, to their usual foraging areas; this severely limits the possibility that they can be exchanged *live* between individuals or groups. Kelly (1988) described these systems of pig production as 'forage-based'; they require relatively low inputs of labour. Kelly used the Etoro case to challenge earlier theoretical argument that proposed direct causal links between the elaboration of Highland socio-economic systems and increases in the relative abundance of pigs.

In many low and mid-altitude areas of New Guinea human population density is low, forage for pigs is presumably abundant but the ratio of domestic pigs to people is low. Kelly (1988) suggested that societies located in these areas underutilize available forage. Instead, they direct minor surpluses of garden produce (or sago) to a relatively small number of mature pigs that might be either confined in cages (e.g. Keraki) or closely bonded to their carers and the normal residential sites of those carers (e.g. Marind Anim, Miyanmin, Baktaman). While agreeing that the availability of forage is not limiting in these areas I think Kelly de-emphasized the importance of forage to the pigs that were kept by societies of the low and mid-altitudes.

Beek (1987: 26) referred to mature Bedamuni pigs that were 'left to roam about in the forest', Barth (1975: 35) commented that 'fully trained' Baktaman pigs 'can be allowed to roam freely',

Hyndman (1979: 212-213) reported that Wopkaimin allowed domestic pigs 'to spend a considerable amount of time foraging in the Mid-mountain Rainforest and secondary forest' and Baldwin (1982: 36-37) wrote that pigs kept by the coastal Gogodala 'are provided with only a minimum of food' but, rather, forage on scraps within the village area and 'venture into the nearby bush, where ... they seek out and consume such diverse wild foods as fruits, roots, worms, grubs, as well as reptiles and small mammals'. Although, in all these societies, pigs receive some rations directly from people, and, as with Etoro (Kelly, 1988: 116; Dwyer, 1990: 58), may do so through most of their lives, the impression left by most reports from low and mid-altitude societies is that, as with Etoro and as Morren (1977: 294) wrote of Miyanmin, very little human effort is expended on the production of pigs. Management of pigs by Kubo did not fit this generalization.

Management of pigs by Kubo was, at the least, time-intensive. For 12 to 18 months pigs were in the daily care of women. They were five months old before they spent the day foraging apart from their carers; among other low and mid-altitude societies, and in the Etoro case, this is about the maximum age at which the bond between pig and carer is relaxed by releasing the pig to forage alone or with other pigs. 'Tended' Kubo pigs were routinely provided with fodder, though they foraged as well, and, once released to 'free forage' in the forest, were regularly visited and often provided with pith from sago palms that had been felled on their behalf. I suggested above that 'free foraging' animals were effectively foddered for much of the time. The use of sago as a reliable source of fodder for these animals had the effect that their movements within the forest were likely to be localized and, with both 'tended' and 'free foraging' pigs, may have contributed to the moderately high growth rates inferred earlier. Hughes (1970) summarized experimental data that showed that pigs fed on sago gained more weight than others fed on sweet potato; he noted also that the fibrous pith of *Metroxylon* sago, which is favoured as pig fodder, is rich in protein. Certainly, 'free foraging' pigs were noticeably fatter than the wild pigs killed by Kubo men. Most of the latter were taken in the forested foothills; all of the former had lived in the backswamps.

On a day to day basis the management of pigs by Kubo was not labour intensive. About 6% of banana production was directed to pigs; some of this probably derived from bunches of inferior quality. This is less than Morren's (1977: 294)

estimate of 16.2% of Miyanmin garden produce fed to pigs in the form of undersized tubers and scraps and, of course, much less than the estimates of 30% or more of garden produce directed to pigs among societies of the Highlands (e.g. Rappaport, 1968; Waddell, 1972; Hide, 1981). Again, though Kubo pigs were fed much sago, the labour investment here was small. With 'tended' pigs the on-going tasks were providing (and sometimes cooking) food, attention to hygiene, making tether and lead ropes and, with larger pigs, the retrieval of animals that broke tether and wandered free within the village. Carers had much latitude as regards daytime management: they could 'herd' their pigs, which happened sometimes and had the effect that the woman concerned could do little else at the same time; they could tether the pigs in the forest which meant that the tether sites had to be changed several times in the day; or, as happened most often, they could combine the care of pigs with whatever other activity they had chosen for the day. Again, therefore, it was the investment of time and not of labour that was of primary significance in the management of pigs by Kubo. And the important outcome of this pattern of investment was that the bond established between a pig and its carer was exceptionally strong and, effectively, non-transferable. This bond was more important than bonds to specific foraging areas that might be established through long term familiarization with those areas. Domestic pigs sometimes returned from the forest, or crossed the Strickland River, to find their carers; I have no records of pigs returning to favoured foraging areas (cf. Dornstreich, 1973: 244). This argument has implications concerning patterns of management in areas where human populations are relatively mobile (cf. Hyndman, 1979: 212).

Relative to descriptions of pig management practices among other low and mid-altitude societies of the interior, Kubo practices were similar as regards low investment of labour but differed in terms of the much greater investment of time, the importance of fodder (where this includes sago) and a heightened degree of bonding. Except on one count they differed in the same ways from

Etoro. Though Kelly (1988: 119) concluded that Etoro pig-keeping practices 'require minimal labor inputs' he did not refer to the fact that Etoro gardens are fenced and that this task is necessary only because both wild and domestic pigs are strongly attracted to sweet potato. Indeed, at higher altitudes of Etoro territory, wild pigs were rare and all garden fencing (8.27km in 12 months by 109 people; Dwyer, 1990) must be regarded as labour invested in the management of pigs. Thus, among Etoro, the investment of labour in the management of domestic pigs is, in fact, relatively high as, of course, it is among Highlanders who must fence gardens to protect sweet potato<sup>2</sup>.

Among Kubo the investment of time in the care of pigs and the bond established between pigs and their carers were correlated. Both may be linked, at least in part, to the fact that Kubo kept many dogs that were life threatening to free-running piglets (Dwyer & Minnegal, 1992b) and to the necessity to isolate the numerically small domestic population of pigs from the very much larger wild population. Kubo pig management practices constructed 'psychological' fences between domestic pigs and their wild counterparts; without this barrier there might have been no 'domestic' pigs. In fact, among Kubo, the 'tended' pigs of one carer were effectively isolated from those of any other carer; this is not the usual state of affairs elsewhere in New Guinea. Taken overall, this discussion of Kubo management procedures suggests that future comparative analyses should attempt to disassociate the variables of fodder vs forage, time vs labour investment, and bonding to carer vs bonding to foraging area. In earlier studies these have been often treated simplistically. Within New Guinea, there are multiple expressions and many possible combinations of these important variables.

#### PIGS AND NUTRITION

Pigs feature prominently in proposed explanations of social and agricultural evolution in New Guinea. The central theme of most accounts within this genre is a concern with the emergence and elaboration of Central Highland's formations from precursors in which the social relations

<sup>2</sup>There is a problem for analysts here. When Kubo people fence tuber gardens they state that they are doing so to control pigs; it is easy to categorize the work as connected with the management of pigs. But when Highlanders, and Etoro, initiate gardens by enclosing areas within a fence their perceptions appear to be that the work is integral to gardening despite the fact that there would be no need for that work if there were no pigs. Analyses of the division of labour associated with different subsistence domains might reach different conclusions when making fences is regarded as gardening or as pig management respectively. Conclusions might vary also as the perspective of analysis shifts from 'operational' to 'cognized' in the sense of Rappaport (1968).

within and between groups were different and the production of both garden foods and pigs was less intensive (Morren, 1977; Watson, 1977; Modjeska, 1982; Feil, 1987; Kelly, 1988). These accounts differ from each other in the emphases assigned to ecological and social determinants of the context and process of change, in the connections proposed between pig production and expressions of inequality within social groups and, indeed, in situating gender inequality as relatively early or relatively late in the proposed evolutionary sequences.

One theme, however, appears to unite these interpretations: intensification of pig production within New Guinea is thought to be connected with a decrease in the availability of wild animal protein sources. This connection may be explicit or implicit. It is associated with either the earlier phases of transformation (e.g. Morren, 1977; Watson, 1977; Modjeska, 1982; Feil, 1988; see also Golson, 1982) or thought to emerge later as human and pig populations increased in parallel and the demands of the former led to forest reduction and a need to provide pigs with large amounts of garden produce in lieu of forage (Kelly, 1988). The former view, at least, implies that domestic pigs were an important source of supplementary animal protein even in areas where the ratio of pigs to people was low.

At the most, the average daily contribution of protein from domestic pigs was 3.75g per 'adult' Kubo consumer (i.e. 15% of edible meat with consumption values for children adjusted as in Dwyer & Minnegal, 1991b). This is less than 10% of the protein derived from wild vertebrates. In addition, Kubo ate many invertebrate animals, with crayfish, shrimps (*Macrobrachium*) and weevil larvae adding considerably to the intake of animal protein. Meat from domestic pigs was eaten irregularly and there was no suggestion that domestic animals were killed to fill shortfalls in the supply of meat from wild animals. By New Guinea standards, Kubo ate a lot of animals; their protein intake was probably well in excess of requirements and, hence, the minor contribution from domestic pigs cannot be interpreted as having threshold significance.

I conclude that the production of domestic pigs by Kubo was of no importance in terms of protein nutrition. It is likely that, with few caveats, this conclusion applies throughout New Guinea. It may be the case with some societies that domestic pigs are killed and consumed at times when other sources of protein are scarce or, more likely, that other sources, though available, are foregone at

times when domestic pigs are eaten (cf. Morren, 1977: 289). It may be also the case among some Highland societies that protein is generally scarce and the consumption of domestic pigs tips the balance in favour of adequate requirements. But I cannot agree with the statement that for most Highlanders domestic pigs are 'the major source of high-quality protein' (Golson & Gardner, 1990: 396).

The nutritional advantage of animal foods over most plant foods is that the former provide a balanced array of amino acids and, as well, may be the only locally available source of vitamin B12. Some amino acids, often described as the 'essential' amino acids or implicated by statements such as 'complete' or 'high quality' protein, appear to be present in few plant foods. These, together with the more widespread amino acids, must be eaten regularly if human protein nutrition is to be adequate. In New Guinea, pork from domestic pigs is neither eaten in sufficient quantity nor with sufficient regularity to make a significant, on-going contribution to minimal amino acid requirements. Hide (1981: 508) estimated that Waula (Sinasina) people received only 3g protein/person/day from domestic pigs and that, on average, households consumed pork once a fortnight. Through the 12 months of Hide's study the ratio of pigs to people varied between 0.83 and 0.89. Assuming that off-take is proportional to the relative size of local pig populations it is unlikely that the protein contribution from domestic animals approaches 10g/person/day anywhere within New Guinea. Unless it is shown that this is achieved regularly and not, as the literature consistently suggests, very irregularly the conclusion remains unaltered. Norgan et al. (1974) reported high levels of protein intake derived from plant foods among Papua New Guinean Highlanders. Analyses of the amino acid content of New Guinean plant foods are needed to advance understanding of protein nutrition in areas where wild animals seem to contribute little to local diets.

Sorenson (1976: 54) wrote of the Fore that 'sometimes there were periods of several consecutive months without pork, followed by several days of glut after a ceremonial feast'. Occasions of excessive pork consumption are widely reported from Highland societies (e.g. Vayda, 1972: 906). From a nutritional perspective their significance is less likely to concern protein balance than to pose the risk of protein poisoning. Protein foods are potentially toxic unless they are eaten with sufficient quantities of

foods that supply energy (Noli & Avery, 1988; Speth, 1990, 1991). Where protein, from either plants or animals, is used as an energy source then the safe level of intake may fall well below 50% of total calories and, for pregnant females, may be as low as 25% of total calories. Further, high levels of intake of lean meat may be unsafe unless total calories from carbohydrates or fats is increased above normal levels. Noli & Avery (1988: 396), referring to earlier reviews by McGilvery and Speth, wrote that 'when protein is used as the sole source of energy by humans it can lead to nausea and diarrhoea in as little as three days .... It is also clear from the various case study examples cited by Speth that consumption of lean meat alone led to symptoms of starvation and protein poisoning within a week, diarrhoea within 7-10 days, severe debilitation within 12 days and the possibility of death within weeks'. We were reprimanded often by Kubo when we did not cook sago to accompany meals of pork; the people were not convinced that rice was a sufficient substitute for sago.

Carbohydrate foods and fats provide energy in the diet. New Guineans often reduce carbohydrate intake when pork is available in quantity but they may offset the risk of protein poisoning because they prefer, and in many societies deliberately promote, fat pigs. The thought of fat pigs was keenly anticipated by Kubo. A month before the feast one man exclaimed '*Sori! O wai safei kau*' ('Sorry! The fat of domestic pigs is abundant'). The ethnographic literature from New Guinea abounds with reports of similar statements. Baktaman rub pigs with special white, powdered earth to magically promote fat (Barth, 1975: 35), the ideal Keraki pig was one that grew so fat it could not stand (Williams, 1936: 18), Sanio Hewa castrated all domesticated male pigs 'at a few months of age "to make them lie around and get fat"' (Townsend, 1969: 49) and, for the same reason, Marind Anim kept only barrows (van Baal, 1966: 406). In the Highlands people may prevent sows from breeding or increase the supply of food to pigs as deliberate attempts to fatten animals in readiness for killing (e.g. Hide, 1981). Comparable statements or procedures that extol the value of the *meat* of domestic pigs are very rare.

Throughout New Guinea, whether the ratio of domestic pigs to people is high or low, the significance of the animals is located in the social and not the nutritional sphere. If there are, as well, nutritional benefits then these concern fat more than they concern protein. In the first place, fat pigs reduce the risk of protein poisoning, especially on occasions when much pork is eaten and the normal intake of carbohydrate foods is reduced. Here, the nutritional role of fat is indirect - it is a source of energy that reduces risks associated with eating large amounts of meat. In addition, however, early nutritional surveys within New Guinea consistently reported that fat (including lipids) was poorly represented in local diets (e.g. Oomen, 1971). On this count, therefore, the nutritional significance of the fat from domestic pigs may be also, at some times and in some places, direct.

#### PIGS AND GENDER

Conventional wisdom has it that among Highland societies inequalities among men and between men and women are intimately tied to patterns of pig production (e.g. Modjeska, 1982; A.J. Strathern, 1982; but contrast with Kelly, 1988). Men strive for prestige. They do so by publicly exchanging valuables, especially pigs and pork. But the labour and time required to rear those pigs has been, for the most part, invested by women. Thus, in pursuit of prestige and leadership, men compete with one another, appropriating the labour of women to their own ends in the process. The outcome is that relations of inequality emerge among males, and women are disenfranchised and disempowered. Under the standard argument these inequalities between individuals and sexes are likely to be greatest where the ratio of domestic pigs to people is highest (cf. Feil, 1987). Indeed, a poignant focus of Highland exchange systems is that, ultimately, the labour invested by women in the production of pigs becomes the means whereby men acquire other women as brides in exchange for those pigs<sup>3</sup>.

Among Kubo, relations between men and women were characteristically relaxed and warm. There was no ethos of sexual antagonism and little concern with sexual pollution (cf. Sørum, 1984, on Bedamuni). Public expressions of affec-

<sup>3</sup>In contrast to the standard argument, Feil (1987: 57-58) asserted that gender inequalities were least severe among societies of the Western Highlands where ratios of pigs to people were particularly high and agricultural production was intensive. He thought that 'it is in societies where production and exchange are truncated and circumscribed ... that inequalities, especially between men and women in the production process are the most severe'. M. Strathern (1988) provides a challenging counter to Feil's understanding of gender relations in the Western Highlands.



tion between husband and wife were relatively common (e.g. holding hands, resting in the lap of one's spouse, play-fighting). Aggressive fights were very rare and, for husbands in particular, triggered self-recrimination and a lengthy period of awkward reconciliation. In the subsistence domain, gender roles were conventional and complementary rather than culturally legislated and they were often transgressed. Women sometimes hunted, men sometimes pounded the pith of sago palms and young girls could play with bows and arrows. Though men and women slept in different sections of the communal longhouse, women were not prohibited from entering the men's section. At family houses in the village, gardens or forest there was even less spatial separation between husband and wife.

Kubo women participated less than men in ritual life. They did not dress up and dance as men did (Dwyer & Minnegal, 1988) and, with the possible exception of a focal individual, they (and their pigs) were excluded from seances and the closing moments of curing ceremonies; here, however, the perceived danger was not so much to the women themselves as to infants, including the unborn, with whom women closely associated. But women performed as lead singers and as chorus on all occasions when men danced and, though young women were not initiated, both older men and older women acted as formal sponsors to male initiates. (Among neighbouring Samo, young women were also initiated; Shaw, 1990.)

By New Guinean standards the extent to which female carers of domestic pigs were necessary and active participants when the animals were killed, butchered and distributed was unusual. In ideal circumstances affinal exchanges of pork entailed the simultaneous distribution of meat from two pigs, one contributed by each of the participating groups. This paralleled the ideal of immediate sister exchange as the basis of Kubo marriages. With both the marriages and the exchanges of pork either of the focal women - a bride-to-be or a pig's carer - could veto the intended arrangements. Again, the ideal of simultaneity might not be met because one of the intended partners was judged to be too young or one pig was judged to be too small.

The control that Kubo women exercised over the disposal of domestic pigs may be linked to management practices. The ratio of pigs to people was unexpectedly high and the time devoted to rearing the pigs was considerable. Nearly all the work was done by women and the strategies of management were such that domestic pigs were

so closely bonded to particular carers that the animals were non-transferable. (It seems unlikely that this statement will remain true in the new circumstance of communal swine-herding that is being developed by Kubo.) The permission and physical presence of a pig's carer was perceived as essential when the pig was killed. Though carers were not necessarily owners their engagement with a particular pig persisted through the life of that pig. Because pigs in the care of one woman were effectively alienated from association with other people, and from the pigs owned by those people, there was little opportunity for men to usurp the role of women as the time approached to kill the pigs.

Among Etoro it was the person who completed a process of production who controlled distribution of the product (Kelly, ms.); with domestic pigs it was men who retrieved the animals that were to be killed, who killed and butchered them and who distributed pork at events where other men were the public recipients of the gifts (see also Dwyer, 1990: 130-132). By contrast, among Kubo, women prepared the pigs for dispatch, stood with them as they were killed and officiated at distributions. Their participation was greater and more overt than that described for Baruya women by Godelier (1986: 15-16). From the perspective advanced by Kelly the role of Kubo women is understandable; they were needed to complete the process of production and, hence, shared in the process of distribution. But was that role necessary?

It is difficult to assign either ecological or social imperative to the patterns of pig production and disposal described here for Kubo. There were more pigs than expected and, by comparison with ecologically similar societies, it appears that they could have been managed with far less commitment from carers and with far more latitude for dispersing the caring role. Domestic pigs do not need to be dangerous to people who are not their primary carers! The importance of the animals was not to nutrition but, rather, to the satisfaction of a variety of social concerns. At these events the role and status of women may have been less pronounced if management strategies had been different. The simple conclusion is that Kubo patterns of pig production empowered women and contributed to the markedly egalitarian ethos of Kubo society. This conclusion may seem analogous to that of Feil (1987) regarding Tombema-Enga of the Central Highlands; the analogy, however, would be superficial because any similarities arise within social and ecological contexts that

are entirely different. Both Kubo and Tombema-Enga represent distinct transformations of the commonalities that underlie and unite Melanesian social life (cf. M. Strathern, 1988).

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#### LITERATURE CITED

- BALDWIN, J.A. 1982. Pig rearing and the domestication process in New Guinea and the Torres Strait region. *National Geographic Society Research Reports* 14: 31-43.
1990. Muruk, dok, pik, kakaruk: Prehistoric implications of geographical distributions in the southwest Pacific. Pp. 231-257. In Yen, D.E. & Mummery, J.M.J. (eds), 'Pacific production systems: Approaches to economic prehistory'. (Australian National University: Canberra).
- BARTH, F. 1975. 'Ritual and knowledge among the Baktaman of New Guinea'. (Yale University Press: New Haven).
- BAYLISS-SMITH, T. & GOLSON, J. 1992. A Colocasian revolution in the New Guinea Highlands? Insights from Phase 4 at Kuk. *Archaeology in Oceania* 27: 1-21.
- BEEK, A.G. VAN. 1987. 'The way of all flesh: Hunting and ideology of the Bedamuni of the Great Papuan Plateau (Papua New Guinea)'. (Unpublished PhD thesis, University of Leiden, Leiden).
- BOYD, D.J. 1984. The production and management of pigs: Husbandry option and demographic patterns in an Eastern Highlands herd. *Oceania* 55: 27-49.
1985. "We must follow the Fore": Pig husbandry intensification and ritual diffusion among the Irakia Awa, Papua New Guinea. *American Ethnologist* 12: 119-136.
- DORNSTREICH, M.D. 1973. 'An ecological study of Gadio Enga (New Guinea) subsistence'. (Unpublished PhD thesis, Columbia University, New York).
- DWYER, P.D. 1990. 'The pigs that ate the garden: A human ecology from Papua New Guinea'. (University of Michigan Press: Ann Arbor).
- DWYER, P.D. & MINNEGAL, M. 1988. Supplication of the crocodile: A curing ritual from Papua New Guinea. *Australian Natural History* 22: 490-494.
1990. Yams and megapode mounds in lowland rainforest of Papua New Guinea. *Human Ecology* 18: 177-185.
- 1991a. Hunting and harvesting: The pursuit of animals by Kubo of Papua New Guinea. Pp. 86-95. In Pawley, A. (ed.), 'Man and a half: Essays in Pacific anthropology and ethnobiology in honour of Ralph Bulmer'. (The Polynesian Society: Auckland).
- 1991b. Hunting in lowland tropical rainforest: Towards a model of non-agricultural subsistence. *Human Ecology* 19: 187-212.
- 1992a. Ecology and community dynamics of Kubo people in the tropical lowlands of Papua New Guinea. *Human Ecology* 20: 21-55.
- 1992b. Cassowaries, chickens and change: Animal domestication by Kubo of Papua New Guinea. *Journal of the Polynesian Society* 101: 373-385.
1993. Banana production by Kubo people of the interior lowlands of Papua New Guinea. *Papua New Guinea Journal of Agriculture, Forestry and Fisheries* 36: 1-21.
- DWYER, P.D., MINNEGAL, M. & WOODYARD, V. 1993. Konai, Febi and Kubo: The northwest corner of the Bosavi language family. *Canberra Anthropology* 16(1) (in press).
- FEIL, D.K. 1987. 'The evolution of Highland Papua New Guinea societies'. (Cambridge University Press: Cambridge).
- GELL, A. 1975. 'Metamorphosis of the cassowaries: Umeda society, language and ritual'. (The Athlone Press: London).
- GODELIER, M. 1986. 'The making of great men: Male domination and power among the New Guinea Banaya'. (Cambridge University Press: Cambridge).
- GOLSON, J. 1982. The Ipomoean revolution revisited: Society and sweet potato in the upper Wahgi valley. Pp. 109-136. In Strathern, A. (ed.), 'Inequality in New Guinea Highland societies'. (Cambridge University Press: Cambridge).
- GOLSON, J. & GARDNER, D.S. 1990. Agriculture and sociopolitical organization in New Guinea highlands prehistory. *Annual Reviews in Anthropology* 19: 395-417.

- HERDT, G.H. 1981. 'Guardians of the flutes: Idioms of masculinity'. (McGraw-Hill Book Company, New York).
- HIDE, R.L. 1981. 'Aspects of pig production and use in colonial Sinasina, Papua New Guinea'. (Unpublished PhD thesis, Columbia University, New York).
- HUGHES, I. 1970. Pigs, sago, and limestone: The adaptive use of natural enclosures and planted sago in pig management. *Mankind* 7: 272-278.
- HUGHES, P.E. & VARLEY, M.A. 1980. 'Reproduction in the pig'. (Butterworths: London)
- HYNDMAN, D.C. 1979. 'Wopkaimin subsistence. Cultural ecology in the New Guinea Highland fringe'. (Unpublished PhD thesis, University of Queensland, St Lucia).
- KELLY, R.C. 1988. Etoro suidology: A reassessment of the pig's role in the prehistory and comparative ethnology of New Guinea. Pp. 111-186. In Weiner, J.F. (ed.), 'Mountain Papuans: Historical and comparative perspectives from New Guinea fringe highlands societies'. (University of Michigan Press, Ann Arbor).
- ms 'Constructing inequality: The fabrication of a hierarchy of virtue among the Etoro'.
- KUCHIKURA, Y. 1990. Subsistence activities, food use, and nutrition among the Mountain Ok in Central New Guinea. *Man and Culture in Oceania* 6: 113-137
- MALYNICZ, G.L. 1970. Pig keeping by the subsistence agriculturalist of the New Guinea highlands. *Search* 1: 201-204.
- MODJESKA, N. 1982. Production and inequality: Perspectives from central New Guinea. Pp. 50-108. In Strathern, A.J. (ed.), 'Inequality in New Guinea highlands societies'. (Cambridge University Press: Cambridge).
- MORREN, G.E.B. 1977. From hunting to herding. Pigs and the control of energy in montane New Guinea. Pp. 273-315. In Bayliss-Smith, T.P. & Feachem, R.G. (eds), 'Subsistence and survival: Rural ecology in the Pacific' (Academic Press, London).
- NOLI, D. & AVERY, G. 1988. Protein poisoning and coastal subsistence. *Journal of Archaeological Science* 15: 395-401.
- NORGAN, N.G., FERRO-LUZZI, A. & DURNIN, J.V.G.A. 1974. The energy and nutrient intake and the energy expenditure of 204 New Guinean adults. *Philosophical Transactions of the Royal Society of London, Series B* 268: 309-348.
- COMEN, H.A.P.C. 1971. Ecology of human nutrition in New Guinea: Evaluation of subsistence patterns. *Ecology of Food and Nutrition* 1: 1-16.
- RAPPAPORT, R.A. 1968. 'Pigs for the ancestors: Ritual in the ecology of a New Guinea people'. (Yale University Press: New Haven).
- RUBEL, P.G. & ROSMAN, A. 1978. 'Your own pigs you may not eat: A comparative study of New Guinea societies' (Australian National University Press, Canberra).
- SHAW, R.D. 1990. 'Kandila: Samo ceremonialism and interpersonal relationships'. (University of Michigan Press: Ann Arbor).
- SORENSEN, E.R. 1976. 'The edge of the forest: Land, childhood and change in a New Guinea proto-agricultural society'. (Smithsonian Institution Press: Washington).
- SØRUM, A. 1984. Growth and decay: Bedamini notions of sexuality. Pp. 318-336. In Herdt, G.H. (ed.), 'Ritualized homosexuality in Melanesia'. (Cambridge University Press, Berkeley).
- SPETH, J.D. 1990. Seasonality, resource stress, and food sharing in so-called "egalitarian" foraging societies. *Journal of Anthropological Archaeology* 9: 148-188.
1991. Protein selection and avoidance strategies of contemporary and ancestral foragers; unresolved issues. *Philosophical Transactions of the Royal Society of London, Series B* 334: 265-270.
- STRATHERN, A.J. (ed.) 1982. 'Inequality in New Guinea Highland societies'. (Cambridge University Press: Cambridge).
1988. Conclusions: Looking at the edge of the New Guinea Highlands from the center. Pp. 187-212. In Weiner, J.F. (ed.), 'Mountain Papuans: Historical and comparative perspectives from New Guinea fringe highlands societies'. (University of Michigan Press: Ann Arbor).
- STRATHERN, M. 1988. 'The gender of the gift: Problems with women and problems with society in Melanesia'. (University of California Press: Los Angeles).
- TOWNSEND, P.K.W. 1969. 'Subsistence and social organization in a New Guinea society' (Unpublished PhD thesis, University of Michigan, Ann Arbor).
- VANBAAL, J. 1966. 'Dema: Description and analysis of Marind-Anim culture (south New Guinea)'. (Martinus Nijhoff, The Hague).
- VAYDA, A.P. 1972. Pigs. Pp. 905-908. In Ryan, P. (ed.), 'Encyclopaedia of Papua New Guinea' (Melbourne University Press: Carlton).
- WADDELL, E. 1972. 'The mound builders: Agricultural practices, environment, and society in the Central Highlands of New Guinea'. (University of Washington Press: Seattle).

- WATSON, J.B. 1977. Pigs, fodder, and the Jones effect in postipomoean New Guinea. *Ethnology* 16: 57-70.
- WILLIAMS, F.E. 1936. 'Papua of the Trans-Fly'. (Clarendon Press: Oxford).
- YEN, D.E. 1991. Domestication: The lessons from New Guinea. Pp. 558-569. In Pawley, A. (ed.), 'Man and a half: Essays in Pacific anthropology and ethnobiology in honour of Ralph Bulmer'. (The Polynesian Society: Auckland).